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Characteristics of German foreclosed residential assets, their real values and discounts. An empirical study.

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ABSTRACT

In the year 2011, over 50,000 houses were sold at foreclosure sales in Germany with an estimated value of 6 billion Euros. As the international literature proved in the past, foreclosed real estate assets usually sell at a discount and damage the value of house prices, which implies a vast harm to the national economy. However, the accurate discount rates of German foreclosure sales and their conjunct reasons have not been suspect of any scientific research so far.

Therefore, this article shall estimate the discount rates and examine the default prices by analyzing the foreclosure sales. For this purpose, we merged three unique datasets: One dataset with normal residential market prices (non-foreclosure sales), one dataset of foreclosed real estate residential values and another dataset with regional economic indicators and average residential prices. The aforementioned datasets are divided into the 16 German federal states and include the years from 2008 until 2011. A distinctive feature of the merged dataset is, that it represents the population of all foreclosed real estate assets in Germany during the time between 2008 and 2011, which allows us to identify the main characteristics of foreclosed residential assets and their real values as well as their discounts. Finally, we estimate another (logit)-regression to illustrate the probability of default for German residential real estate assets before placing our results into the context of the international literature.

Key-words: foreclosure sales, hedonic pricing, valuation, distress, Germany

1. Introduction

The German housing market has usually been considered as the last safe haven in Europe, as price volatility used to be comparatively low and the German finical market is said to be stable. Often this has been explained by conservative financing (low LTV, Pfandbrief refinancing, relatively low homeownership rates) and structural effects like low economic momentum and (partly related to this) demographic burden between 2002 and 2010.

As a result house prices increased significantly faster since 2009, construction activity starting to pick up and many private investors eyeing at residential investments as the last asset class, which promised a safe cash-return.

However, one should never forget that these stylized facts might change. The default risk has been low and decreased significantly in Germany, but it is not nil. Especially if one bears in mind that in the year 2011, over 50,000 houses were sold at foreclosure sales in Germany with an estimated value of 6 billion Euros.

As the international literature proved in the past, foreclosed real estate assets usually sell at a discount and damage the value of house prices, which implies a vast harm to the national economy. However, the accurate discount rates of German foreclosure sales and their conjunct reasons have not been suspect of any scientific research so far.

Therefore, this article shall estimate with the help of a hedonic regression model the discount rates and examine the default prices by analyzing the foreclosure sales. For this purpose, we merged three unique datasets: One dataset with normal residential market prices (non-foreclosure sales), one dataset of foreclosed real estate residential values and another dataset with regional economic indicators and average residential prices. The aforementioned datasets are divided into the 16 German federal states and include the years from 2008 until 2011. A distinctive feature of the merged dataset is that it represents the population of all foreclosed real estate assets in Germany during the time between 2008 and 2011, which allows us to identify the main characteristics of foreclosed residential assets and their real values as well as their discounts.

Subsequently we analyze the default risk for German residential properties. Therefore we are separating economic, structural and real estate related factors. While default risk is primarily driven by economic risk factors of the mortgage debtor, our research question is, whether or not further real estate related factors add to or minimize the default risk of a mortgage. This shall be analyzed with the help of a (logit)-regression model to illustrate the probability of default for German residential real estate assets and their associated micro- and macroeconomics reasons.

The results have significant implications for financial institutions, who might ask for different property-specific risk premia, and it can have implications for regulatory bodies during a crisis.

Our study analyses both the discount of a foreclosed property to its market value and the probability of default of a mortgage, while offering an innovative way of conceptualizing and estimating potential effects for real estate residential assets.

2. Literature Review

In the scientific literature, a large number of authors already dealt with price differences of distressed and non-distressed residential properties. Although the used calculation methods, for example repeat-sales methods (Pennington-Cross, 2006, Harding et al., 2012) or hedonic regression models (Clauretie & Daneshvary 2011, Aroul & Hansz, 2014), differ strongly from one another with respect to the research design and experimental set-up, there is a consensus in the literature regarding the discounts: Even though divergent interpretations and implications do exist, all authors ascertained that the examined foreclosure sales and procedures caused a statistically significant discount. Pennington Cross (2006) for example argues that the foreclosed properties for sale suffer damage rather through long auction procedures and that therefore their values are negatively affected. In order to determine the value growth of a property, the author compared prices that could be realized at least twice through selling in a certain observation period. In doing so, Pennington-Cross (2006) found that properties that went through a compulsory sale procedure registered a 22% lower value growth as non-distressed properties. However, it was not possible to make any statements whether these discounts originate from the status of distressed assets, the object state and location or other influences.

Other studies revert to hedonic regression models which differ from one another regarding methodology, included object characteristics, as well as further going influences, but also the observation period, region, type of the considered residential property and its seller.
One of the early investigations by Shilling et al. (1990) considers distressed properties from the point of view of a shortened marketing period and therewith associated price discount on the market value of the respective object. Using a multiple regression, the price difference is exemplarily estimated for distressed owner-occupied apartments in Baton Rouge (US state of Louisiana). Apart from a reduced marketing period, they could identify a statistically significant lower price level in contrast to the non-distressed condominiums.
Forgey et al. (1994), as well as Springer (1996) find a statistically significant price discount when comparing single-family homes in Arlington (US state Texas), too. Whereas Forgey et al. (1994) cannot provide further explanations, Springer (1996) is capable of empirically explaining a part of the price discount through selling pressure. Based on investigations by Shiling et al. (1990) and Forgey et al. (1994), Hardin & Wolverton (1996) identify statistically significant lower selling prices for non-owner-occupied apartments in Phoenix (US state Arizona). A further difference to prior research lies in the inclusion of potential rents at the selling time as a proxy variable for the quality of the individual apartments as well as the influencing factors of the respective locations.

Hardin & Wolverton (1996) interpret the results in a way that primarily banks are interested in quickly selling properties that are released to compulsory auctions. In order to comply with regulatory and legal standards, as well as to get rid of risky positions in their balance sheets, banks are in return willing to tolerate price discounts on the fair market values.

These results are likewise in line with those of Brown (2000) with his analysis of property credit institutions or rather mortgage REITs. On the basis of the collapsing real estate markets in the United States, Brown (2000) could find that credit institutions were rather not willing to restructure their defaulted or distressed real estate credits, as there are no incentives for credit institutions to avoid forced sales – also not in declining markets.

However, Chau & Ng (2008) could identify a differing result for the real estate market in Hong Kong. The study constitutes an extension of previous analyses: Location and aspects of the

object quality are taken into account by the selection of a mainly homogenous residential environment within Hong Kong as an investigation object. Besides, Chau & Ng (2008) distinguish between a clearly good and bad market situation und find in times of positive market climate a statistically significant price discount for foreclosure sales objects. They explain this relation by the fact das credit grantors have an interest in prompt disposals of distressed apartments during positive market conditions and that as long as their claims are satisfied, they accept to sell at prices below market values.

Aroul & Hansz (2014) additionally capture in their estimations endogenous relations between price and marketing period of REO-sellings and short sellings. As many of the previous studies were performed in times of relative stability, Aroul & Hansz analyzed transactions from a period of volatile real estate markets between 2006 and 2010 in Fresno, California. The years 2006 and 2007 represent relatively normal market conditions, whereas a highly volatile market environment enters the estimations via the transactions in the subsequent years. In contrast to the results by Chau & Ng (2008), they observe – especially in times of great turbulences in the real estate market - higher statistically significant price discounts for distressed properties compared to calmer periods. On the overall average, the price discounts amounted to 21% on properties sold in compulsory auctions and 14% on distressed properties sold in short sale procedures.

Caroll et al. (1997) come to further findings. In the on Forgey et al. (1994) based model for the Las Vegas Valley (US state Nevada), the authors take into account explanatory variables for the direct environment of the problematic objects in addition to the macro-location. This provides a further statistically significant contribution to the explanation of price difference between distressed and non-distressed properties. Carroll et al. (1997) argue that when the environment characteristics are not explicitly included in a model, their effect can be caught erroneously by the foreclosure status variable as a proxy.

The investigation by Clauretie & Daneshvary from the year 2009 goes in the same direction. They likewise specifically include further influencing factors that are often associated with distressed objects in form of independent variables. Thereby their effect is not illustrated by the status as objects with foreclosure status any more, but can be analyzed individually. By additionally taking into consideration endogenous influences and spatial autocorrelations, the authors find a statistically significant price discount for the analyzed foreclosure sales objects in Las Vegas, that can be solely attributed to the foreclosure status. Clauretie & Daneshvary slightly modified this model in 2011 and increased the number of object and location factors. Through the integration of the additional variables, the authors could identify a further transfer effect which affects the neighboring properties: Foreclosure proceedings and REO transactions have a negative transfer effect that amounts to about 1% on average on the property prices in the direct neighborhood (in the area of about 160 meters and for times of sell that go back not more than 3 months).

Biswas (2012) as well could identify a negative transfer effect of foreclosed or distressed properties on the property prices in the neighborhood. Besides, Biswas enhanced the model by further building classes. The heterogeneity of an existing housing stock in central locations of an organically grown neighborhood makes it possible to analyze the impacts of different foreclosure property types on the neighborhood cultivation. The author could not only identify a permanent negative effect of foreclosure sale objects in the direct neighborhood, but also the fact that the entire submarket can sustainably be influenced by certain types of foreclosures. For example, distressed multiple dwellings caused a permanent negative transfer effect of about 3% on the prices of neighboring properties within a radius of 200 to 400 meters.

Gerardi et al. (2015) could furthermore ascertain that the date on which the owner of the distressed property does not service the loan rate any more determines the starting point of the transfer effects.
Foreclosure sales have thereby not only a negative impact on the affected property itself, but also on neighboring objects. Besides, Calomiris et al. (2013) could determine that a strongly increasing number of foreclosure sales can also have an impact on the growth of the whole economy. In order to examine the scope of rapidly growing foreclosure sales activities on an economy, Calomiris et al. (2013) analyzed the falling housing prices during the subprime crisis due to increased foreclosure rates. The authors could ascertain that foreclosure sales have in general a negative influence on property prices, but that after all, the influence of decreasing housing prices on foreclosure sales is even greater.
The investigation by Hott (2011) deals with on US American housing prices during the subprime crisis, too. However, it puts its focus on the lending behavior of banks. Hott (2011) assumes that the bursting of the real estate price bubble and the falling property prices, as well as the resulting distressed properties were caused or at least intensified through the (wrong) lending policies by the banks themselves.

Koetter & Poghosyan (2010) could detect a similar conjunction for the German market. The authors could determine that not only heavily falling real estate prices can have a negative impact on the stability of banks, but also rapidly increasing property values. On the basis of increasing real estate prices in Germany, Koetter & Poghosyan (2010) prove that bank instability and the resulting probability of "financial distress" may rise.
Mian et al. (2015) also analyzed housing prices and the property sector under the special effect of the subprime crisis and the resulting increase of foreclosure sales. For this purpose, they compared judicial foreclosure procedures with non-judicial foreclosure procedures. The authors could ascertain that the property prices in US states without judicial foreclosure sales in the period from 2006 until the beginning of 2009 had fallen by 38%, whereas housing prices in US states with judicial foreclosure procedures had fallen only by 23%. The impact of different foreclosure procedures is considerable, especially when one takes into account that during the years 2008 and 2009, an increase of 15% has taken place.
Cordell et al. (2015) analyzed the respective process duration of the two different foreclosure sales procedures. In contrast to Mian et al. (2015), they made the assumption that longer process durations lead to higher costs for the foreclosure sales performing creditor and thereby to higher losses. Cordell et al. (2015) could demonstrate that the durations of proceedings significantly increased during the subprime crisis and that they amounted to 20 months on average for judicial foreclosure procedures and about 13 months for non-judicial foreclosure procedures. Cordell et al. (2015) could establish that the prolongation or respectively the postponing of the procedure lead to on average 15% additional costs, which had to be borne by the operators of the foreclosure procedures. For non-judicial procedures, only an increase of about 4% arised.
It could also be verified that longer process durations did not lead to a prevention of the foreclosure and consequently, costs for the lender, as well as social costs for the borrower could not be avoided (Cordell & Lambie-Hanson, 2016).

Campbell et al. (2011) also realize that the market values of houses are not only determined by general supply and demand conditions. Furthermore, the market values are affected by idiosyncratic risks, such as urgent sales or the impacts of a transfer of ownership on the physical quality of a house. The authors could find that the discount is increasing with ongoing process duration. Only after more than three years of process duration, the foreclosure discount will eventually diminish.

In contrast to the investigation by Campbell et al. (2011), Harding et al. (2012) focus on the price discount that is exclusively caused by the foreclosure status and that cannot be explained by other factors. On the basis of a repeat-sales method, Harding et al. (2012) calculate an average excess return of about 1.4% p.a. for acquirers who purchased distressed properties. Whereas non-distressed real estate achieved a return of 8.5% p.a. on average, acquirers of distressed properties realized a return of about 9.9% p.a. on average.
Moreover, by the means of a hedonic regression model, Harding et al. (2012) could ascertain that price functions and characteristic attributes of distressed and non-distressed real estate differ from one another, as different market agents are addressed to.

The analysis in the literature clearly points out that even though the examined studies differ in part strongly from each other regarding their study design, the results are in general concordant and distressed properties or respectively properties sold in compulsory auctions can have a large impact on the concerned property itself, but furthermore the on neighborhood, as well as on whole submarkets.

3. Data

We merged three unique datasets: One dataset with residential market prices for regular conditions (non-foreclosure sales), one dataset of foreclosed real estate residential values and another dataset with regional economic indicators and average residential prices. The aforementioned datasets are divided into the 16 German federal states and include the years from 2008 until 2011. A distinctive feature of the merged dataset is, that it represents the population of all foreclosed real estate assets in Germany during the time between 2008 and 2011, which allows us to identify the main characteristics of foreclosed residential assets and their real values as well as their discounts. After the correction for data errors and missing values our dataset contains 611.148 observations, 125.545 of which are foreclosed real estate assets. Numerous explanatory variable are introduced for all of our observations, the following table shows the variable names along with the descriptive statistics. Table 1 shows the price discount of foreclosed properties by building class and quality.

Table 1: Discount on foreclosure sales by building type (descriptive statistics)

Mittelwerte der Wohnimmobilienklassen (Marktwerte bzw. Verkehrswert), Gesamt Deutschland

	EFH	Differenz	ETW	Differenz	Reihenhaus	Differenz	Aggregiert	Differenz
Nicht Zwangsversteigert Ø							161,718	-25.3%
Durschnitt	284,462	-14.2%	147,736	-31.9%	268,320	-11.2%	161,094	0.0%
Einfach	147,407	-23.8%	81,678	-14.4%	155,961	-16.3%	101,884	-10.0%
Gut	361,366	-27.6%	232,316	-47.0%	329,905	-26.7%	243,720	-6.2%
Zwangsversteigert Ø							120,819	
Durschnitt	243,975		100,630		238,359		161,106	
Einfach	112,273		69,940		130,510		91,711	
Gut	261,451		123,096		241,758		228,506	

Mittelwerte der Wohnimmobilienklassen (Marktwerte bzw. Verkehrswert), Westdeutschland

	EFH	Differenz	ETW	Differenz	Reihenhaus	Differenz	Aggregiert	Differenz
Nicht Zwangsversteigert Ø							159,083	-16.6%
Durschnitt	282,787	-9.7%	145,449	-28.2%	265,986	-8.4%	159,062	7.9%
Einfach	151,883	-19.5%	85,056	-13.9%	159,075	-12.1%	106,564	-7.1%
Gut	361,956	-25.9%	219,085	-39.6%	310,168	-21.0%	232,025	2.5%
Zwangsversteigert Ø							132,658	
Durschnitt	255,259		104,492		243,599		171,585	
Einfach	122,195		73,240		139,820		98,975	
Gut	268,370		132,225		244,975		237,767	

Mittelwerte der Wohnimmobilienklassen (Marktwerte bzw. Verkehrswert), Ostdeutschland

	EFH	Differenz	ETW	Differenz	Reihenhaus	Differenz	Aggregiert	Differenz
Nicht Zwangsversteigert Ø							174,016	-49.8%
Durschnitt	291,370	-31.6%	156,570	-42.4%	280,964	-28.7%	169,003	-25.2%
Einfach	114,850	-24.0%	65,915	-5.0%	120,612	-20.1%	77,068	-3.8%
Gut	357,800	-40.4%	293,289	-69.3%	417,147	-51.1%	298,698	-42.8%
Zwangsversteigert Ø							87,401	
Durschnitt	199,184		90,197		200,192		126,455	
Einfach	87,243		62,638		96,327		74,120	
Gut	213,331		89,913		203,925		170,744	

4. Methodology

Model 1:
In our first step we use a simple regression Modell (pooled OLS) to explain the effect of the foreclosure status on the announced building price. Our descriptive statistics have shown average foreclosure discounts of approx. 20% which is in line with the literature. However, the discounts may occur due to unobserved heterogeneity in the quality of distressed properties compared to "normal" ones. We therefore **control** for a wide range of property specific features as well as macroeconomic parameters and fixed effects for the time and region (J = 36). Equation 1 shows the estimated equation and highlights the effect of foreclosure status which is to be analyzed.

Equation 1: Pooled OLS equation of Model 1

$$\ln(\text{value}_i) = \propto + \beta_{dis} \cdot \text{distressed}_i + \left[\sum_{j=1}^{J} \beta_j \cdot \text{feature}_{ji}\right]$$

The valuations of the individual properties are denoted by value_i. β_dis captures the percentage foreclosure discount, controlled for the information inside the variable set J (i.e. property- and location specific features)

Model 2:
In addition to the average total amount of the discount (see Model 1), the distribution of the discount is of main concern for drawing practical implications. We therefore interact the control variable set of our first model with the distressed-dummy, in order to disaggregate the foreclosure discount (J=K).

Equation 2: Pooled OLS equation of Model 2 with interaction terms

$$\ln(\text{value}_i) = \propto + \beta_{dis} \cdot \text{distressed}_i + \left[\sum_{j=1}^{J} \beta_j \cdot \text{feature}_{ji}\right] + \left[\sum_{k=1}^{K} \beta_k \cdot (\text{feature}_{ki} \cdot \text{distressed}_i)\right]$$

As Chapter 5 will show, we are able to observe how the foreclosure discount (as calculated in Model 1) will distribute amongst the different property characteristic captured in the regression coefficients of the interaction term, namely ßk.

5. Results

Looking at the descriptive statistics we already see distinct discounts for distressed and non-distressed real estate assets. As these values represent averages of the whole dataset, these discounts and values can only be used as an indication. Yet, these values illustrate the structural differences between the markets and asset types. Aggregated market prices in West Germany are more homogeneous than in East Germany. On the other hand the spread of the fiduciary value of the distressed real estate assets are nearly the same for Eastern and Western Germany. The biggest price variation, between the market prices and the fiduciary values, was identified in the group of the good locations. The smallest variation was identified within the group of the basic locations.

However, the discounts may occur due to unobserved heterogeneity in the quality of distressed properties compared to "normal" ones. We therefore **control** for a wide range of property specific features as well as macroeconomic parameters and fixed effects for the time and region. Table 2 will show the regression results for Model 1 along with some interpretation of the main findings.

Table 2: Estimation results Model 1

N	611148
Prob > F	0.000
R^2	0.763
Root MSE	0.328

dependent: log of property value	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
foreclosure status	-0.1934	0.0034	-62.6600	0.0000	-0.2003	-0.1865
living area	1.1562	0.0029	405.2400	0.0000	1.1505	1.1619
number of rooms	-0.0268	0.0009	-28.5300	0.0000	-0.0287	-0.0249
number of households in district	0.0796	0.0010	83.0300	0.0000	0.0776	0.0815
unemployment rate	-0.0286	0.0002	-129.9600	0.0000	-0.0290	-0.0281
age	-0.0200	0.0001	-387.2600	0.0000	-0.0201	-0.0199
age^2	0.0002	0.0000	322.9000	0.0000	0.0002	0.0002
no extra features						
carport	0.0035	0.0010	3.6100	0.0000	0.0016	0.0055
private garden	0.0454	0.0010	43.8900	0.0000	0.0434	0.0474
additional toilet	0.0313	0.0014	21.8700	0.0000	0.0285	0.0342
elevator	0.1036	0.0011	92.1200	0.0000	0.1015	0.1058
balcony	0.0489	0.0011	44.1600	0.0000	0.0467	0.0510
year:2008						
year:2009 [reference: 2008]	-0.0101	0.0013	-8.1200	0.0000	-0.0126	-0.0076
year:2010 [reference: 2008]	-0.0331	0.0055	-6.1100	0.0000	-0.0441	-0.0221
year:2011 [reference: 2008]	-0.0819	0.0056	-15.3500	0.0000	-0.0930	-0.0707
type: flat						
type:house [reference: flat]	0.0058	0.0014	4.0800	0.0000	0.0029	0.0086
type:town house [reference: flat]	0.0090	0.0038	2.3600	0.0180	0.0014	0.0166
state: Bavaria						
state: Saxony-Anhalt [reference: Bavaria]	-0.1177	0.0013	-97.0500	0.0000	-0.1203	-0.1151
state: Hesse [reference: Bavaria]	-0.1494	0.0022	-73.2600	0.0000	-0.1538	-0.1450
state: Saxony [reference: Bavaria]	-0.3021	0.0056	-64.3700	0.0000	-0.3133	-0.2909
state: Bremen [reference: Bavaria]	-0.2869	0.0046	-73.4100	0.0000	-0.2961	-0.2777
state: Thuringia [reference: Bavaria]	-0.0384	0.0030	-13.2500	0.0000	-0.0443	-0.0324
state: Hamburg [reference: Bavaria]	-0.0840	0.0017	-50.5900	0.0000	-0.0874	-0.0805
state: Baden-Württemberg [reference: Bavaria]	-0.0649	0.0064	-10.4600	0.0000	-0.0777	-0.0521
state: Brandenburg [reference: Bavaria]	-0.2783	0.0023	-143.8400	0.0000	-0.2828	-0.2737
state: Saarland [reference: Bavaria]	-0.2252	0.0015	-169.7800	0.0000	-0.2282	-0.2222
state: Berlin [reference: Bavaria]	-0.2394	0.0023	-118.7200	0.0000	-0.2440	-0.2348
state: Rhineland-Palatinate [reference: Bavaria]	-0.3823	0.0065	-74.1200	0.0000	-0.3953	-0.3693
state: North Rhine-Westphalia [reference:	-0.4337	0.0035	-164.7400	0.0000	-0.4406	-0.4268
state: Lower Saxony [reference: Bavaria]	-0.5219	0.0077	-95.7700	0.0000	-0.5373	-0.5065
state: Schleswig-Holstein [reference: Bavaria]	-0.0027	0.0034	-0.7900	0.4300	-0.0096	0.0042
state: Mecklenburg-Vorpommern [reference:	-0.3577	0.0077	-57.6000	0.0000	-0.3731	-0.3424
market classification: A						
market classification: B [reference: A]	-0.0802	0.0015	-56.2600	0.0000	-0.0832	-0.0772
market classification: C [reference: A]	-0.0556	0.0024	-23.6400	0.0000	-0.0604	-0.0507
market classification: D [reference: A]	-0.1384	0.0027	-55.5700	0.0000	-0.1437	-0.1330
market classification: Regio [reference: A]	-0.1818	0.0018	-108.8700	0.0000	-0.1855	-0.1781

As the preliminary main result we observe a foreclosure discount between 13.7% and 19.34%, depending on the variable set J. Model 1 shows the most conservative result with 19.34%. Almost all p values are below well below the 5% level and our R^2 of 76.3% shows the high explanatory power of the overall model.

In addition to the average total amount of the discount (see Model 1), the distribution of the discount is of main concern for drawing practical implications. We therefore interact the control variable set of our first model with the distressed-dummy, in order to disaggregate the foreclosure discount. Table 3 shows the regression results for Model 2 along with some interpretation of the main findings. We show the interaction term ßk right beside the estimated partial effects ßj

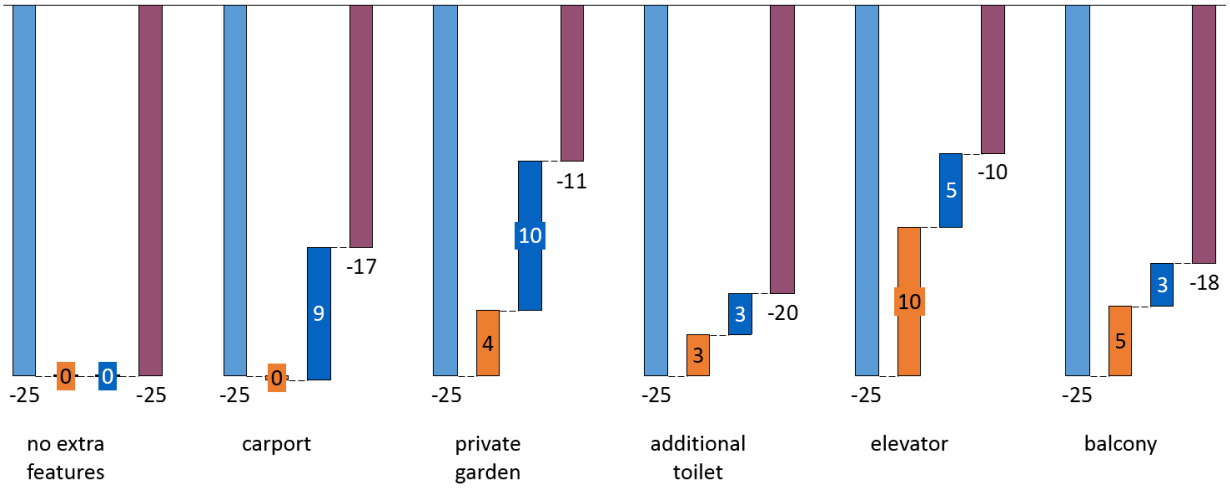
Table 3: Estimation results Model 2

N	611148
Prob > F	0.000
R^2	0.766
Root MSE	0.326

		Partial effects		*Interaction terms*	
dependent: log of property value	**category**	**Robust Coef.**	**P>t**	**Robust Coef.**	**P>t**
foreclosure status	(dummy)	-0.255	0.000		
living area	(log metric)	1.175	0.000	-0.374	0.000
number of rooms	(metric)	-0.031	0.000	0.046	0.000
number of households in district	(log metric)	0.081	0.000	-0.034	0.000
unemployment rate	(metric)	-0.029	0.000	0.014	0.000
age	(metric)	-0.020	0.000	0.004	0.000
age^2	(metric)	0.000	0.000	0.000	0.000
no extra features					
carport	(dummy)	-0.003	0.004	0.087	0.000
private garden	(dummy)	0.045	0.000	0.098	0.000
additional toilet	(dummy)	0.028	0.000	0.028	0.001
elevator	(dummy)	0.102	0.000	0.049	0.000
balcony	(dummy)	0.047	0.000	0.029	0.000
year:2008					
year:2009 [reference: 2008]	(dummy)	-0.012	0.000	-0.006	0.374
year:2010 [reference: 2008]	(dummy)	0.003	0.884	-0.036	0.081
year:2011 [reference: 2008]	(dummy)	-0.015	0.573	-0.058	0.037
type: flat					
type:house [reference: flat]	(dummy)	0.001	0.501	0.260	0.000
type:town house [reference: flat]	(dummy)	0.004	0.336	0.251	0.000
state: Bavaria					
state: Saxony-Anhalt [reference: Bavaria]	(dummy)	-0.526	0.000	0.042	0.028
state: Hesse [reference: Bavaria]	(dummy)	-0.085	0.000	0.026	0.070
state: Saxony [reference: Bavaria]	(dummy)	-0.438	0.000	0.022	0.052
state: Bremen [reference: Bavaria]	(dummy)	-0.286	0.000	-0.031	0.690
state: Thuringia [reference: Bavaria]	(dummy)	-0.361	0.000	-0.050	0.032
state: Hamburg [reference: Bavaria]	(dummy)	-0.041	0.000	-0.053	0.001
state: Baden-Württemberg [reference: Bavaria]	(dummy)	-0.117	0.000	-0.061	0.000
state: Brandenburg [reference: Bavaria]	(dummy)	-0.304	0.000	-0.076	0.000
state: Saarland [reference: Bavaria]	(dummy)	-0.382	0.000	-0.079	0.001
state: Berlin [reference: Bavaria]	(dummy)	-0.152	0.000	-0.110	0.000
state: Rhineland-Palatinate [reference: Bavaria]	(dummy)	-0.237	0.000	-0.113	0.000
state: North Rhine-Westphalia [reference: Bavaria]	(dummy)	-0.222	0.000	-0.136	0.000
state: Lower Saxony [reference: Bavaria]	(dummy)	-0.275	0.000	-0.145	0.000
state: Schleswig-Holstein [reference: Bavaria]	(dummy)	0.010	0.006	-0.282	0.000
state: Mecklenburg-Vorpommern [reference: Bavaria]	(dummy)	-0.037	0.000	-0.434	0.000
market classification: A					
market classification: B [reference: A]	(dummy)	-0.081	0.000	0.046	0.000
market classification: C [reference: A]	(dummy)	-0.057	0.000	0.033	0.006
market classification: D [reference: A]	(dummy)	-0.140	0.000	0.083	0.000
market classification: Regio [reference: A]	(dummy)	-0.184	0.000	0.085	0.000

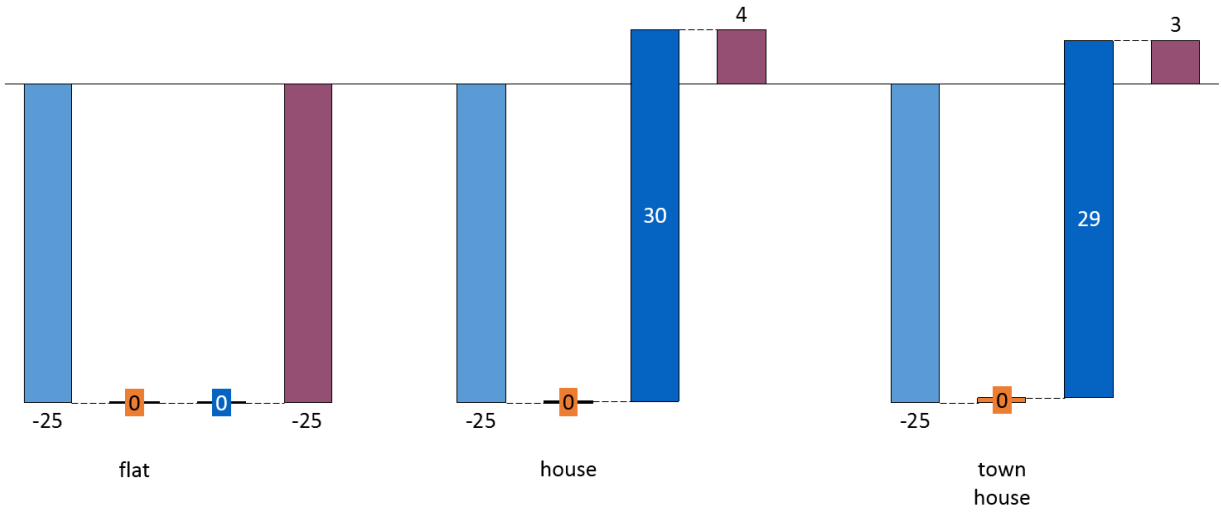
To interpret the results, we chose a graphical representation of the estimated coefficients shown above in table 3.

Figure 1: Features



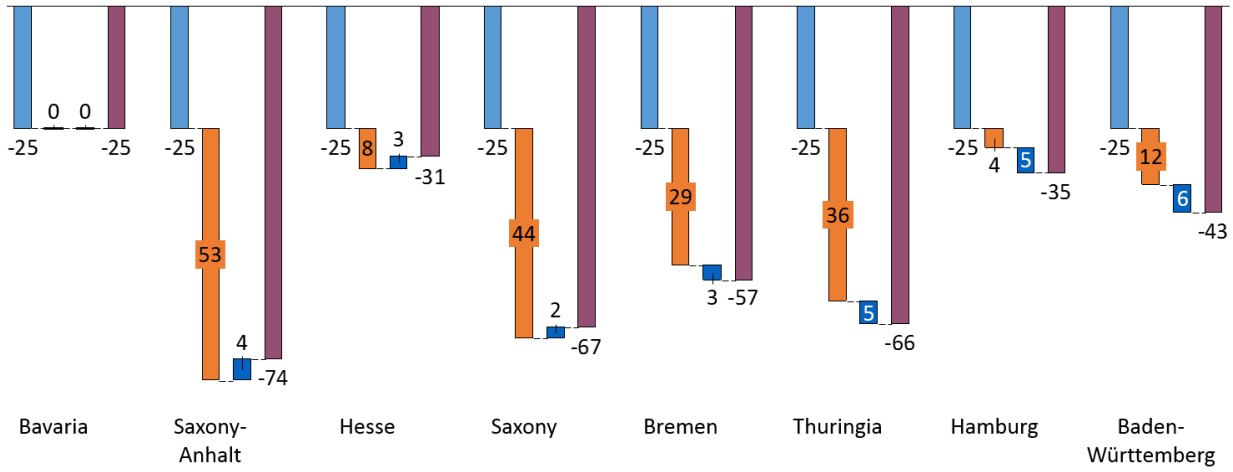
Features like a carport, a private garden or an additional toilet did not drastically improve the analyzed property values per se (orange pillars). **However: Those features seem to be a credible signal for high quality properties, since the respective properties exhibit a significantly lower foreclosure discount (blue pillars).**

Figure 2: Property Type



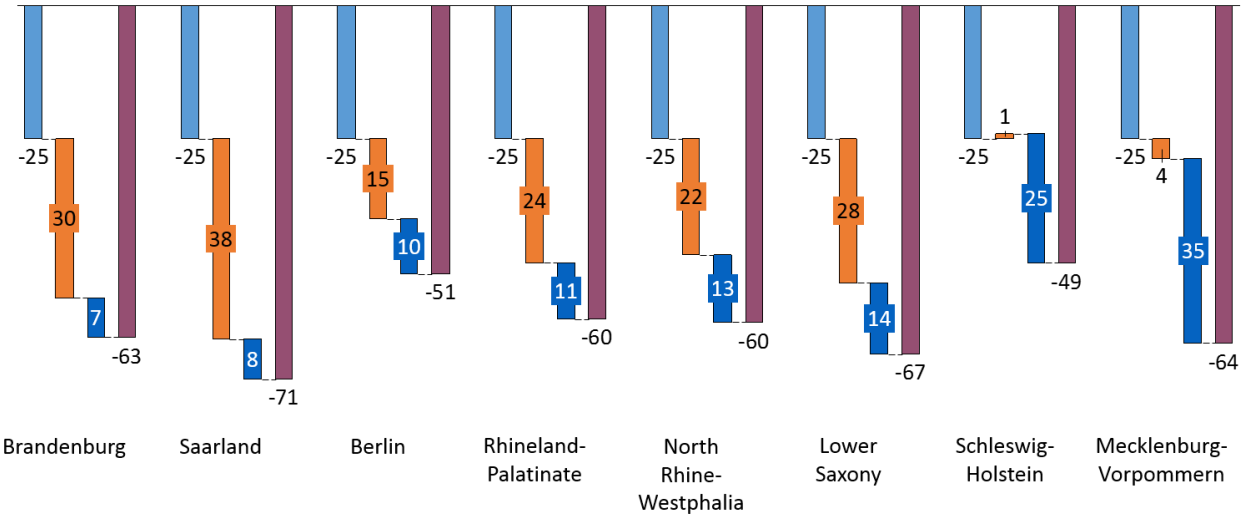
Houses and town houses seem to have no foreclosure discount ceteris paribus. The purple pillars are even positive. However, purple pillars as the sum of the three parameters (1) ß_dis (2) ß_house (3) the interaction term cant be tested statistically significant!

Figure 3: State



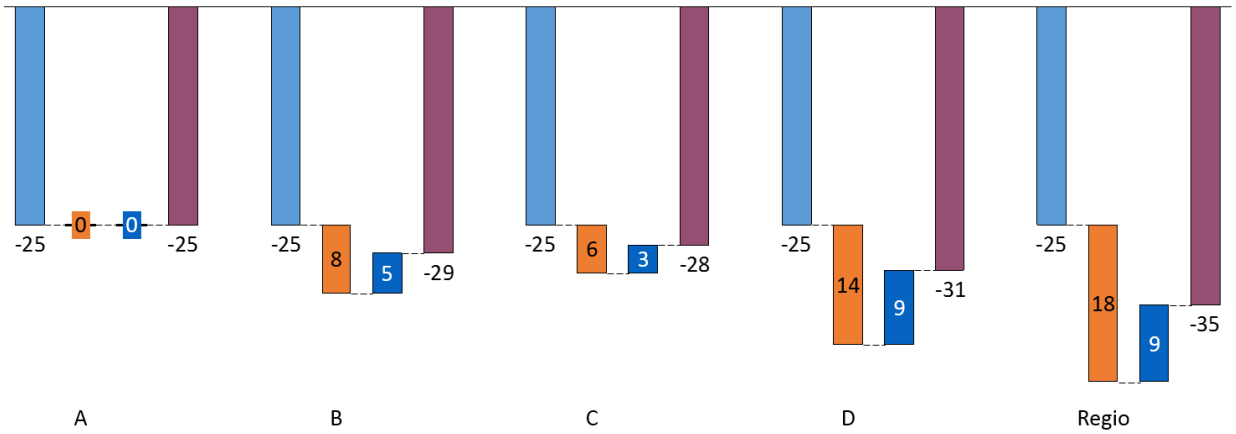
The states above show a relatively low additional foreclosure discount (some states even show a premium!). However, the underlying reasons may differ (1) while Hesse, Hamburg and BW have a quite low state specific discount to begin with, (2) Saxony-Anhalt, Saxony and Thuringia have low additional foreclosure discounts just because of the massive devaluation from the low state specific discount, which leaves little to no potential for further discounts.

Figure 4: State



The states above show a relatively high additional foreclosure discount. **Again: the devaluation from the state specific discount itself is highly diverse.**

Figure 5: Market Type



Puzzeling results at the first sight, but maybe there is a selection bias: Does the probability of a foreclosure depend on the market liquidity and therefore the market type? We think so!

6. Preliminary Conclusion

The foreclosure status itself destroys a part of the value of a property, even after the introduction of numerous control variables. This effect can be quantified as approximately 20% for the German residential market, which is perfectly in line with the international literature For some types of property, we found that the discount is predictably lower/high compared to other types. **This has wide-ranging practical implications, for example for credit risk management (i.e. managing exposure at default).**

7. Literature

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